MSLC Workshop Series
Math 1151 – Workshop 1
Limits and Continuity

Warm-up:

Let and let . Are *f* and *g* equivalent functions? Why or why not? Hint: Try factoring the numerator of .

Draw the graphs of and .



# Definitions

# A graph increasing from zero two to six five. there are holes at two three and three four, with an isolated point at two five A graph increasing from zero two to six five. there is a hole at two three, with an isolated point at two five. the hole at three four from the previous picture has been filled with a closed dot

# Limits:

There is a technical definition, but for us, the intuitive definition will do just fine. Here it is:

The limit is the value the function “gets close to” if we make the *x* values “get close to” (but not equal to) *.* We write .

# Continuity:

**Definition:** A function is continuous at if and only if .

This definition actually states three things:

 1.

 2.

 3.

# Part 1: Limits and Continuity given by a Graph

Let be given by the graph below. Use the graph to find the following.

1. a.

b.

c. Is continuous at ?

d.

1. a.

b.

c.

d. Is continuous at ?

1. a.

b.

c.

d.

e. Is continuous at ?

f.

1. a.

b.

c.

d.

e. Is continuous at ?

f.

1. a.

b.

c.

d.

e. Is continuous at ?

f.

g.

# Part 2: Limits and Continuity given by an Equation

**Hints about finding Limits:**

* Plugging in nearby numbers will get you no credit unless the directions specifically say to do so.
* For any function which is CONTINUOUS, you can find the limit just by plugging in the number as long as the answer is defined.
	+ In particular we know the following functions and all their combinations are continuous wherever they are defined:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Ways you can combine continuous functions to get another continuous function:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What do you do if the function is undefined? Look at the form of the limit!

# Limits Problems:

1. List the asymptotes of . Justify your answers by citing appropriate limits. Explain how you know there are no others.
2. List the asymptotes of . Justify your answers by citing appropriate limits. Explain how you know there are no others.

# Comparison of Limits vs. Continuity

## Limits

### Conceptually

Where is the function headed (y-value) as you get near a certain x-value?

### Graphically

No jumps or infinite squiggles, ignore the point itself

### Algebraically

Limits from both sides have to agree

### Math Notation

 is defined on an interval on both sides of

## Continuity

### Conceptually

Can you draw it without picking up your pencil?

### Graphically

No holes, breaks or infinite squiggles

### Algebraically

1. Limits from both sides have to agree
2. The y-value of the point has to agree with the limit

### Math Notation

1. is defined

# Squeeze Theorem

Let . Evaluate the limit:

# Intermediate Value Theorem

If is a continuous function on the closed interval , and is any value between and , then there is a number in such that .

We will use the IVT to show that the equation

has a solution on the interval (1, 10).

1. IVT requires a single function, . What is your choice for ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **On which interval** do we need to show that is continuous? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Explain why is continuous on that interval.
4. Evaluate and .
5. IVT requires a number, . What is your choice for ?
6. Fill in the blanks appropriately (according to your answers above):
7. Based on your answers above, explain how to use IVT to determine that the equation has a solution in the interval (1, 10).